DEVELOPMENT OF THE TECHNOLOGY AND RESEARCH OF HYDROGEL WITH THE COMBINATION OF ALGINATE AND ETHONIUM FOR IMMEDIATE-RELEASE DRUG DELIVERY SYSTEMS

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In recent times, there has been notable advancement in the realm of cutting-edge targeted drug delivery systems focused on enhancing therapeutic effectiveness, minimizing side effects, and streamlining application processes. Several controlled-release drug delivery systems, offering various benefits such as reduced side effects, less frequent application, and the ability to achieve the desired drug release profile, have already been created. Transdermal drug delivery systems with controlled release of drugs based on hydrogels have garnered significant interest due to their non-invasive characteristics. Alginate-based hydrogel systems can effectively provide rapid antibacterial protection, promote wound healing, and prevent infections. Hydrogels can also reduce pain in open wounds by preventively moisturizing the bottom of the wound and avoiding desiccation of nerve endings.

The purpose of this study was to develop a technology for obtaining hydrogel systems for the immediate release of drugs and to study the kinetics of the release of a bactericidal drug to facilitate the healing process of open wounds. For this, sodium alginate, partially hydrophobized sodium alginate, anhydrous calcium chloride and sodium carbonate were used. The obtained microparticles were investigated by X-ray diffraction and transmission electron microscopy. Hydrogel samples based on alginate and partially hydrophobized sodium alginate and calcium carbonate microparticles were studied by scanning electron microscopy and nitrogen adsorption-desorption methods. The study of the kinetics of the release of ethonium as a model bactericidal drug was carried out by the UV spectrometric method at different pH values of the environment and temperature.

The release of ethonium from the samples was investigated at 20 °C and 37 °C and three pH levels: 5.5; 7.2 and 8.2, which corresponds to the pH level of blood, healthy skin, and chronic wounds. A slight pH-sensitivity of the release is observed at a temperature of 20 °C and almost completely disappears with an increase in temperature to 37 °C. Complete release of the immobilized medicinal product is achieved in 30 minutes at physiological temperature, regardless of the pH level of the medium.

As a result of the study, hydrogel films based on hydrophobized and pure sodium alginate, microparticles of calcium carbonate and immobilized ethonium were obtained. It was established that microparticles of calcium carbonate, obtained by the method of co-precipitation of salts, have an oval shape with an average particle size of 1.5×2.0 μm. The surface area, volume, and average radius of micropores were determined using the nitrogen adsorption-desorption method. It was established that as a result of crosslinking by the *in situ* method, porous samples with a pore radius from 2.7 to 5.5 nm, a micropore volume from $2.7 \cdot 10^{-2}$ to $7.3 \cdot 10^{-2}$ cm^3/g and an area surfaces from 7 to 30 m^2/h. The study of the kinetics of ethonium release was carried out at different temperatures and pH levels. It is shown that the samples are characterized by immediate release (release rate constants are 0.04–0.11 min^{-1}), which indicates the prospect of further research and development of systems with immediate release of drugs to create systems of specialized delivery of drugs to wounds of various etiologies. Due to the natural origin of the polymer base, such samples can be considered potential candidates for further research and development of targeted drug delivery systems with immediate release not only for external but also for internal use.